WATER QUALITY IMPROVEMENT STRATEGIES FOR THE EVERGLADES

ALTERNATIVE COMBINATIONS FOR WELLINGTON/ACME BASIN B

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SOUTH FLORIDA WATER MANAGEMENT DISTRICT
West Palm Beach, Florida

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INTRODUCTION

The Wellington/ACME Improvement District Basin B (ACME) has an area of 8,680 acres and is located west of State Road 7, south of State Road 80 and east of Water Conservation Area 1 (WCA 1) in Palm Beach County. A map of the Wellington/ACME Improvement District Basin is presented in *Figure 1*. The ACME Basin is divided into two basins, Basin A and Basin B. This document covers Basin B discharges only. Basin A discharges are covered in the C-51 West system which will be treated in STA-1E.

Basin B is 8,680 acres located south of Pierson Road and east of WCA 1. Runoff from this basin is discharged from interconnected lakes and canals to the L-40 borrow canal within WCA 1. Discharge to the L-40 borrow canal is conveyed through 1-100,000 GPM (222 cfs) pump station and 1-120,000 GPM (267 cfs) pump station.

The two pump stations for Basin B discharge into ponds that are connected through the L-40 levee by culverts to the L-40 borrow canal. These culverts are known as the G94D structure (pump station 2) and ACME1DS (pump station 1). The G94D structure is owned by the District but operated by ACME. The ACME1DS structure and the pump stations are owned and operated by ACME.

The project canals and control structures in the ACME Basin have three functions: (1) to supply water to the basin; (2) to intercept and control seepage from WCA 1 and (3) to provide flood protection and drainage of the ACME Basin. The canals and structures within the ACME Basin are operated by the ACME Improvement District, which is a dependent district of the Village of Wellington.

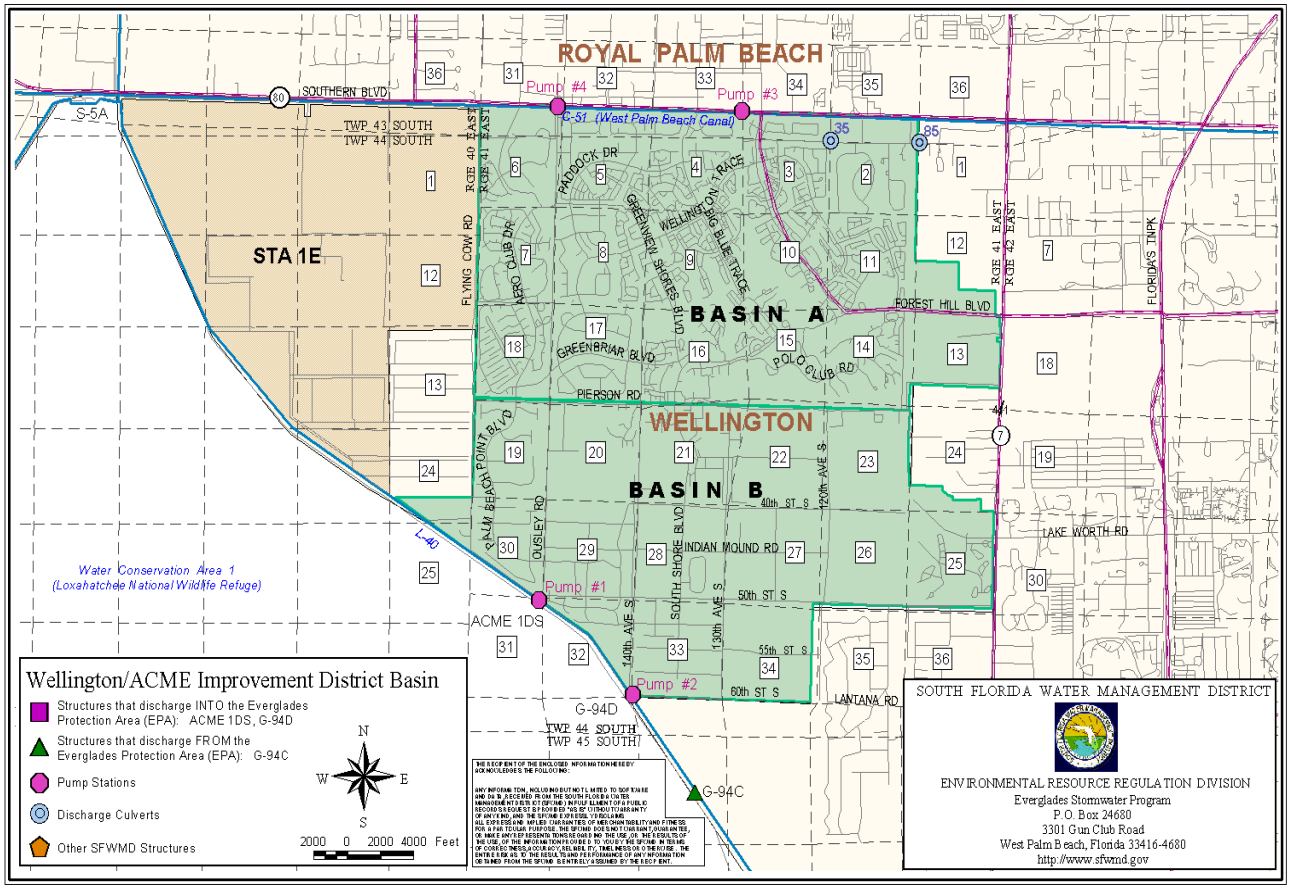
Land Use

Basin B consists of residential areas promoting equestrian activities, equestrian facilities and horse farms, agriculture and golf courses.

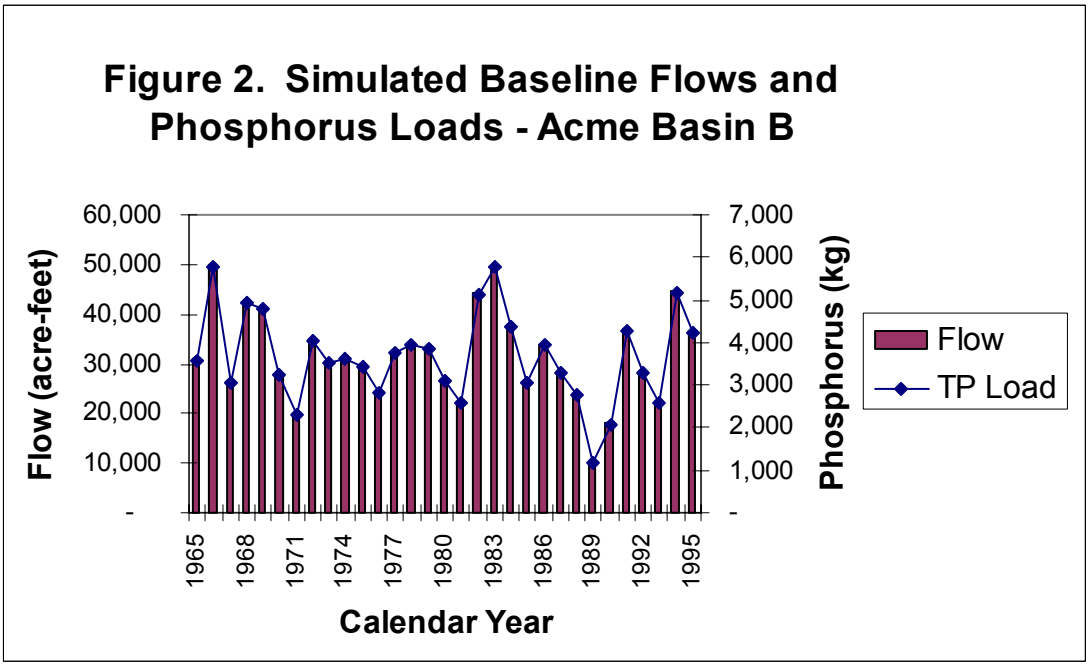
Flow Data

Historic flow and water quality data from the following structures were compiled to generate the baseline data set shown in *Figure 2*.

Pump Station #1 (DBKEY 15022 – historic flow data)
Pump Station #2 (DBKEY 15023 – historic flow data)
L40-1 and ACME1DS – historic water quality data
L40-2 and G94D – historic water quality data



Original map by: Cordella Miessau



Note: The Baseline Flows and Phosphorus Loads shown in Figure 2 are comprised of simulated flows from the South Florida Water Management Model (SFWMM) and observed water quality data from the ten-year period WY 90-99. To develop the Baseline flows, the SFWMM was used to simulate current operational conditions and utilized rainfall for the 31-year period between January 1, 1965 and December 31, 1995. The goal was not to recreate the 31-year period of record flows, but rather, to simulate the expected hydrologic response in the basin as a result of the 31-year rainfall history. The flow-weighted average annual phosphorus concentration of 94 ppb was selected for use in the combined baseline data set. *Reference: Baseline Data for the Basin-Specific Feasibility Studies to Achieve the Long-term Water Quality Goals for the Everglades, SFWMD, May 2001.*

ALTERNATIVES FOR WELLINGTON/ACME BASIN B

Alternative combinations of operational changes, source control, basin-scale treatment and CERP projects for Acme Basin B are presented below. Major components of the alternatives, along with probable influences on the flows and water quality of discharges are briefly described.

The load contribution of phosphorus from Acme Basin B to the Everglades is approximately 4,491 kg per year. The flow weighted mean concentration of TP in the effluent is generally 94 ppb. The following alternatives assume implementation of a combination of source controls, such as Best Management Practices (BMPs), as a component in the reduction of phosphorus concentrations. Other components include basin level treatment or diversion. It is assumed that all alternatives will maintain existing levels of flood protection in the basin.

The Village of Wellington developed a list of water quality improvement options. These options are included in Appendix B in a document titled "Basin B Water Quality Cleanup Options Opinion of Probable Cost". Options 1 and 2 (STA 1West "Bolt On" and GKK Rock Pit respectively) are included as alternatives within the STA 1East and 1West basins since these options propose activities in those basins. The District and Wellington have decided to eliminate Option 5 (Section 34/Section 24/Strazzulla) from the evaluation of Acme Basin B alternatives.

Alternative 1
- Source Control Component (BMPs) by 2006
- Diversion to the Agricultural Reserve Reservoir by 2013

Alternative 2
- Source Control Component (BMPs) by 2006
- Chemical Treatment Component by 2006

Alternative 3
- Source Control Component (BMPs by 2006
- STA within 375 acres of Section 24 owned by the District by 2006

Alternative 4
- Source Control Component (BMPs) in 2006
- STA Component (sized to achieve lowest sustainable TP concentration) by 2006

Note: Separable costs will be provided for previously purchased land(s) which are to be incorporated in alternatives.

Alternative 1 – Implement Best Management Practices (BMPs) by 2006 and divert Acme Basin B Runoff to the CERP Agricultural Reserve Reservoir in 2013.

Description:

A. **Source Control:** It is assumed that stormwater Best Management Practices (BMPs), as defined by the Everglades Stormwater Program (see Appendix A) will be implemented in the basin by 12/31/06. This alternative will be evaluated assuming a 25% reduction in phosphorus loads due to source controls.

B. **Diversion to CERP Project:** This alternative includes construction of a pump station and a canal(s) to direct Acme Basin B runoff to the Agricultural Reserve Reservoir CERP project. These improvements would be constructed in conjunction with the CERP project in 2013. This alternative would require land acquisition for construction of a new canal(s) and a pump station. The new canal(s) will connect directly to the Agricultural Reserve Reservoir with no mixing of waters within the Lake Worth Drainage District (LWDD) canals. The Agricultural Reserve Reservoir CERP Project (CERP component VV) includes construction of a reservoir located adjacent to the Loxahatchee National Wildlife Refuge (Refuge) within the LWDD. Excess stormwater from the LWDD basin and Acme Basin B would be pumped into the reservoir for storage and then discharged back into the LWDD basin for water supply. It is assumed the Agricultural Reserve Reservoir has adequate capacity to accept the Acme Basin B runoff. This alternative is a modification of Option Three in the document *WATER QUALITY CLEANUP OPTIONS,* prepared by the Village of Wellington's Surface Water Action Team (Appendix B).

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls**.**

B. **Diversion to CERP Project:** Prior to 2013 when the alternative is constructed and the Agricultural Reserve Reservoir comes on line, the Baseline flows to the Refuge would continue. After the alternative is constructed and the Reservoir comes on line in 2013, all flows from Acme Basin B will be diverted to the Reservoir.

Influence on Water Quality:

A. **Source Control:** The baseline case for this alternative will assume a 25% reduction in TP loads due to source controls by 12/31/06. As part of a sensitivity analysis, the phosphorus load associated with discharges to the Refuge from Acme Basin B (derived from the Baseline data set) will be varied by 0% and 50%. The influence that these reductions have on the basin outflow load and concentration will be calculated and summarized.

B. **Diversion to CERP Project:** Prior to the 2013 when the alternative is constructed and the Reservoir comes on line, the Baseline loads (adjusted to reflect 25% TP reduction due to source controls) to the Refuge would continue. After the alternative is operational and the CERP project is complete, phosphorus loading will be diverted to the Reservoir.

Costs:

A. **Source Control:** There will be no cost estimates developed for this component.

B. **Diversion to CERP Project:** This alternative will have additional costs associated with the diversion of Acme Basin B stormwater to the Agricultural Reserve Reservoir CERP project including construction of new canals, canal improvements, culvert installation, pump station installation, operation and maintenance of canals and structures, and land acquisition.

Alternative 2 – Implement Best Management Practices (BMPs) and construct a Chemical Treatment Facility by 2006.

Description:

A. Source Control: It is assumed that stormwater Best Management Practices (BMPs), as defined by the Everglades Stormwater Program, will be implemented in the basin by 12/31/06. This alternative will be evaluated assuming a 25% reduction in phosphorus loads due to source controls.

B. Chemical Treatment: Stormwater from Acme Basin B would be pumped into a flow equalization basin located within the 375 acres of Section 24 owned by the District along the western edge of Wellington by 12/31/06. Stormwater runoff from Acme Basin B would first be treated by a chemical treatment facility and then be discharged into a shallow linear retention area located between Wellington's C-27 canal and the L-40 levee prior to being pumped into the Refuge. This alternative was originally described as Option Four in the document *WATER QUALITY CLEANUP OPTIONS,* prepared by the Village of Wellington's Surface Water Action Team (see Appendix B).

Influence on Flow:

A. Source Control: It is assumed that there will be no change in the Baseline flows associated with source controls.

B. Chemical Treatment: It is assumed that there will be no reduction in the Baseline flows associated with this component.

Influence on Water Quality:

A. Source Control: The baseline case for this alternative will assume a 25% reduction in TP loads due to source controls by 12/31/06. As part of a sensitivity analysis, for the 10 ppb outflow case as described in the following paragraph, the phosphorus load associated with discharges to the Refuge from Acme Basin B (derived from the Baseline data set) will be reduced by 50%. The influence that this reduction has on the 50-year present worth cost estimate will be calculated and summarized.

B. Chemical Treatment: It is assumed that the chemical treatment facility will achieve a total phosphorus outflow concentration of 10 ppb regardless of the inflow concentration. As part of a sensitivity analysis, the chemical treatment effluent will be assumed to be 6 ppb and 8 ppb and the influence these concentrations, and the resultant blending of treated and untreated flows, have on the 50-year present worth cost will be evaluated and summarized.

Costs:

A. Source Control: There will be no cost estimates developed for this component.

B. Chemical Treatment: A chemical treatment facility, land acquisition, levees, structures, canals, and O & M costs, etc., will be required in order to implement this alternative.

Alternative 3 – Implement Best Management Practices (BMPs) and construct an STA on 375 acres currently owned by the District by 2006.

Description:

A. **Source Control:** It is assumed that stormwater Best Management Practices (BMPs), as defined by the Everglades Stormwater Program, will be implemented in the basin by 12/31/06. This alternative will be evaluated assuming a 25% reduction in phosphorus loads due to source controls. In addition, the degree of source control required to achieve the lowest sustainable TP concentration by the 375-acre STA will be calculated.

B. **Construct STA:** Stormwater from Acme Basin B would be pumped into an STA located on 375 acres currently owned by the District within Section 24 along the western edge of Wellington. Discharges from the STA would be directed to the Refuge by 12/31/06. The STA will be designed to reduce TP to the lowest sustainable concentration, within the 375 acres currently owned by the District, using the optimal combination of emergent, submerged aquatic vegetation (SAV), and PSTA.

Influence on Flow:

A. **Source Control:** It is assumed that there will be no change in the Baseline flows associated with source controls.

B. **Construct STA:** It is assumed that there will be no change in the Baseline flows associated with this component.

Influence on Water Quality:

A. **Source Control:** The baseline case for this alternative will assume a 25% reduction in TP loads due to source controls by 12/31/06. As part of a sensitivity analysis, the phosphorus load associated with discharges from Acme Basin B (derived from the Baseline data set) will be varied by 0% and 50%. The influence that these reductions have on the STA's outflow concentration will be calculated and summarized. In addition, the degree of source control required to achieve the lowest sustainable TP concentration by the 375-acre STA will be calculated.

B. **Construct STA:** It is assumed the STA facility would achieve a reduced total phosphorus outflow concentration in discharges to the Refuge by 12/31/06 compared to the Baseline data set.

Costs:

A. **Source Control:** There will be no cost estimates developed for this component.

B. **Construct STA:** Land acquisition, levees, structures, canals, and O & M costs, etc., will be required in order to implement this alternative.

Note: Separable costs will be provided for previously purchased land(s) which are to be incorporated in alternatives.

Alternative 4 – Implement Best Management Practices (BMPs) and construct an STA by 2006.

Description:

A. Source Control: It is assumed that stormwater Best Management Practices (BMPs), as defined by the Everglades Stormwater Program, will be implemented in the basin by 12/31/06. This alternative will be evaluated assuming a 25% reduction in phosphorus loads due to source controls.

B. Construct STA: Stormwater from Acme Basin B would be pumped into an STA and discharges from the STA would be directed to the Refuge by 12/31/06. The STA will be sized and evaluated assuming a 25% reduction in phosphorus loads due to source controls. The STA will be sized to reduce TP to the lowest sustainable concentration using the optimal combination of emergent, submerged aquatic vegetation (SAV), and PSTA.

Influence on Flow:

A. Source Control: It is assumed that there will be no change in the Baseline flows associated with source controls.

B. Construct STA: It is assumed that there will be a reduction in the Baseline flows associated with converting a portion of the basin to an STA.

Influence on Water Quality:

A. Source Control: The baseline case for this alternative will assume a 25% reduction in TP loads due to source controls by 12/31/06. As part of a sensitivity analysis, the phosphorus load associated with discharges from Acme Basin B (derived from the Baseline data set) will be varied by 0% and 50%. The influence that these reductions have on the amount of acreage required to achieve the lowest sustainable TP concentration will be calculated and summarized.

B. Construct STA: It is assumed the STA facility would achieve a reduced total phosphorus outflow concentration in discharges to the Refuge by 12/31/06 compared to the Baseline data set.

Costs:

A. Source Control: There will be no cost estimates developed for this component.

B. Construct STA: Land acquisition, levees, structures, canals, and O & M costs, etc., will be required in order to implement this alternative.

Note: Separable costs will be provided for previously purchased land(s) which are to be incorporated in alternatives.

APPENDIX A

Source Control and BMPs

Source control will require the implementation of a comprehensive and basin-wide pollution prevention plan. The plan must include regulation promulgation, public education, hiring and equipping maintenance personnel, infrastructure improvements and hiring compliance and enforcement staff.

Urban Best Management Practices (BMPs) are management practices for urban areas designed to reduce pollution through point and non-point source stormwater discharges. Examples include landscaping maintenance, illicit discharge controls, drainage controls and detention ponds.

Regulatory Programs are developed to improve water quality, including identifying structures or systems requiring permits or modifications to permits. Regulatory programs may include any combination of voluntary BMPs, requirement and/or modification of permits, construction projects and basin-specific regulatory programs to achieve compliance with state water quality standards.

APPENDIX B

BASIN B
WATER QUALITY CLEANUP OPTIONS
OPINION OF PROBABLE COST

The following assumptions were made in regards to the Wellington Basin "B" Water Quality Cleanup. The five options (1 through 5) are global in nature and their components represent major elements within each option. These options are as follows:

Option 1. **STA 1 West "Bolt On"**

Considers the diversion of Basin "B" water to the Water Management District's STA 1 East and STA 1 West. By diverting the Basin "B" Water to STA 1 East, STA 1 West would be expanded westward to accommodate the additional inflows. The expansion would compensate the District STA 1 East for the water from Basin "B" as well as external of the Basin.

Option 2. **GKK Rock Pit/Adjacent STA**

Considers the diversion of water to the GKK mining operation (GKK) for storage and then water quality treatment in an adjacent WPA. The water, after treatment, could then be diverted to several different locations. These locations could be the L-8 Canal, M-1 Canal, West Palm Beach Catchment Area or north to the Loxahatchee Slough, south to the WCA, or west to Lake Okeechobee. This option considers solutions external of Basin "B".

Option 3. **Lake Worth Drainage District Diversion**

Considers the diversion of Basin "B" water east and south to the Lake Worth Drainage District system (LWDD). From the LWDD canals, the water would be pumped into the Agricultural Reserve Area WPA. This option considers the enlargement the existing canals and possibly the enlargement of the WPA. This option considers a solution external of Basin "B".

Option 4. **Section 24 Plus Internal Treatment**

Considers a storage reservoir in Section 24 for the Basin "B" water and flood protection. A stormwater treatment area with chemical treatment would be utilized. The treated water would then be discharged into the wildlife refuge.

Option 5. **Section 34/Section 24/Strazzulla**

Considers various lands within Basin "B" for Reservoirs, Storm Water Treatment Area's (STA's), and Aquifer Storage and Recovery (ASR) Wells. This option considers solutions internal to Basin "B".

The first overall assumption is that each option will require the purchase of property. The size of the property would depend on the solution or the combination of solutions. In addition, infrastructure improvement requirements such as culverts, pump stations, and excavation for storage and marsh creation area's will be evaluated.

The second overall assumption is that each of the above options will require a reservoir and/or storm water treatment area (STA) which would store and filter the storm water. The marsh or STA would provide the majority of the natural phosphorus uptake via the plants within the marsh.

The third overall assumption is that, based on the Village's active BMP Program and the expansion of this program to include new development projects and to retrofit the existing "hot spots", the Village could attain close to a 50 ppb phosphorus concentration within Basin B.

OPTION ONE

Expand STA 1 west and divert Basin B to STA 1E and equalize the flow westward into STA 1 West. This option assumes changing flow in Basin B from south-southwest to north-northwest and directing the Basin "B" water into STA 1 East. The U.S. Army Corps of Engineers has begun construction on STA 1E and this option would channel the Basin "B" water to STA 1E and expand STA 1W westward to accommodate the additional Basin "B" water.

In addition, the existing lands acquired by SFWMD can be incorporated into STA 1 East. This would involve constructing a channel/canal that would link the C-27 Canal to the STA 1E and

the purchase of an additional section of land to compensate for the Basin B water. The assumption is that an additional inflow pump station would be added at Section 24. An outflow pump station may also be required from Section 24 to STA 1E.

OPTION TWO

Diversion of the Basin B water to the GKK Mining Operation. This option assumes changing the flow in the canals from south-southwest to north-northwest. This would include the use of the C-51 Canal to channel the Wellington water westward to the L-8 Canal, then north to the mining operation and the pits created by the GKK operation.

Each of the existing GKK pits is approximately 100 acres in size. One pit would act as a reservoir storage area. An additional section of land would be required for an STA. Once the water has passed through the STA, it could be divided to the L-8 Canal, M-1 Canal, north to the Loxahatchee Slough; C-51 Canal and WCA 1, or northwest to Lake Okeechobee.

To control the flow of water, an additional outflow pump station would be installed at or near the C-1 and C-51 Canals. Three (3) addition pump stations, consisting of two outflows and one inflow, would be required to pump into the retention pit, out into the STA and out of the STA.

OPTION THREE

Divert Basin B water east and south through the Lake Worth Drainage District (LWDD) system into the Agricultural Reserve Area WPA. This option assumes changing the flow in Basin "B" from south-southwest to east-southeast, and directing the Basin B water through the Acme Canals and into the Lake Worth Drainage District Canals.

A pump would be required to elevate and discharge water from Basin "B" into the LWDD Canal system. This option also assumes enlarging the Village's canals for conveyance purposes. The LWDD system would provide some water quality treatment prior to being pumped into the WPA (for water supply storage). An outfall pump station would be constructed within the LWDD right-of-way and is assumed to be part of this project. The enlargement of the WPA may be required to be enlarged by an additional section of land to accommodate the Basin "B" water.

OPTION FOUR

Divert the Basin "B" water westward through the existing canal system to Section 24. This section would become a reservoir for flood protection, water supply and wetland marsh. The phosphorus uptake provided by the marsh would be enhanced chemically. The chemicals used would be similar to those used in water treatment facilities.

In addition, a linear retention area located between the C-27 Canal and the L-40 Levee area would be provided. This linear retention would serve as the conveyance channel to discharge the treated water into the wildlife refuge.

OPTION FIVE

This option is two fold in that it considers various land purchases as either "stand alone" or in concert as reservoirs and marsh areas. The second is the installation of Aquifer Storage and Recovery sites ASR. The land areas available for purchase and their potential use are as follows:

Section 34 – 160± acres as a reservoir
Section 32 – 100± acres as a reservoir
Section 24 – 370± acres as a wetland marsh (STA)
Strazzula – 160± acres as a wetland restoration and rehydration

Construction of reservoirs and wetland marshes on the lands noted above would require the excavation of interior flow-way and dikes and planting of vegetation.

In order to control the flow, in and outward, of the reservoirs and wetlands, inflow and outflow pumps would be required. The assumption is inflow pumps would be required at Section 34 and 24. An outflow pump would be required at Section 24 and the existing pump station numbers 1 and 2 would require modifications to function within the system.